

# Research to Risk Assessment (R2RA) Pilot Project(s) Candidates

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This is an initial list of candidate SRP research projects that have been screened for R2RA workgroup consideration. SRP anticipates that those selected by EPA and ATSDR would be evaluated for collaborative discussions and/or activities to promote the near-term use to assist and advance the assessment of environmental/public health risks of hazardous substances in the environment.

## A. Development and Applications of Integrated *In Vitro* and Cell-Based Bioassays

### **Michael Denison, University of California-Davis**

Accurate identification and quantitation of dioxin-like halogenated aromatic hydrocarbons (HAHs) in environmental matrices are critical for site assessment, risk assessment, and environmental monitoring. Dr. Denison's research team has developed and validated the XDS-CALUX<sup>®</sup> bioassay, which is sensitive to <1 part per trillion for dioxin/furan and polychlorinated biphenyls (PCB) analyses. Dr. Denison has thoroughly validated the method, including participation in the EPA SITE program and receipt of EPA approval for publication in SW-846. The assay is applicable to: biological matrices including blood (whole serum and extracts), breast milk, and tissues extracts; environmental matrices including soil and sediment, ash, and pulp and paper; and food matrices including animal fats (oil and fats), milk and butter, and animal feeds. CALUX has been used in epidemiologic studies and to evaluate the safety of food and drinking water sources primarily in Belgium, Japan, Poland, and to a limited extent in the United States. CALUX has been demonstrated as a faster, cheaper analytic method for Dioxin and PCBs sites and could be used for more extensive sampling to reduce uncertainty in site specific exposure assessments.

## B. Biological Response Indicator Devices for Gauging Environmental Stressors (BRIDGES)

### **Kim Anderson, Oregon State University**

Dr. Anderson refined and combined two technologies to assess the toxicity of bioavailable contaminant mixtures present in the environment. Building upon lab work and field trials conducted at a Superfund Megasite in the lower Willamette River (Portland, OR), her research team created a bio-analytical tool that can assess multiple biological responses to environmentally relevant mixtures in a whole organism vertebrate model. The passive sampling has the potential for broad application to a wide range of contaminants at Superfund sites for determining more accurate exposure levels for risk assessments.

## C. Immunoassays for Enhanced Detection of Toxic Substances

### **Bruce Hammock & Shirley Gee, University of California-Davis**

Immunoassay tools developed by Dr. Gee's team have been utilized by state governments and university researchers to gather more comprehensive information on the relationship of human exposure to environmental chemicals. For example, the researchers have developed assays to detect pesticides including paraquat, permethrin, fipronil and chlorantranilprole;

brominated flame retardants; and antimicrobial compounds in environmental (soil, water, sediment) or biological (urine, blood, saliva) matrices. The standardization and verification of these methods for Superfund contaminants would have direct application to site investigations by EPA and ATSDR.

**D. [In vitro Test Systems to Identify Developmental Neurotoxicants](#)**

**Ted Slotkin, Duke University**

Dr. Slotkin's research team designed an *in vitro* test system using PC12 cells, a cell line that recapitulates the critical stages of neuronal development ranging from cell replication through differentiation and axonogenesis. This system has the potential of providing a rapid and relatively inexpensive method for evaluation cumulative toxicity of contaminants across chemical classes found at Superfund sites thereby influencing the risk assessment and health assessment.

**E. Biomarkers of Exposure to Polycyclic Aromatic Hydrocarbons**

1. [James Swenberg, University of North Carolina-Chapel Hill](#)

Dr. Swenberg demonstrated correlations between PCB exposures, numbers of hepatic M1dG adducts, and incidence of liver toxicity/tumor development. This work provides environmental health researchers and risk assessors with a new, sensitive biomarker of exposure to dioxin-like compounds.

2. [Martyn Smith and Stephen Rappaport, University of California-Berkeley](#)

The results of research led by Drs. Rappaport and Smith suggest that the leukemia risk associated with exposures to environmentally relevant levels of benzene could be substantially greater than currently assumed for the general population, and even higher for subgroups with specific genetic susceptibilities.

Work on the physiological and genetic aspects of PAH exposure by Drs. Swenberg and Rappaport could have application for the study of other hazardous organic substances for improving the science of toxicity and exposure for use in risk assessments at Superfund sites.

**F. Exposures to Volatile Organics**

1. [Kelly Pennell & Eric Suuberg, Brown University](#)

This research team is exploring the broad range of variables that impact vapor intrusion exposure by both constructing computational methods for predicting properties such as vapor pressures and water solubility and field testing in an impacted neighborhood. Multiple volatiles and semivolatiles can diffuse differentially, making the actual exposures a different mixture from the contamination at the source. This work could help cumulative risk assessment by providing a better tool for estimating mixture concentrations.

2. [Mark Brusseau, University of Arizona](#)

Dr. Brusseau is conducting a systematic study of the mass-transfer behavior of chlorinated-solvent immiscible liquids at multiple scales, and investigating the impact of

system properties on mass flux and plume response. His work involves integrated pore-scale, intermediate-scale, and field-scale investigations at a Superfund site, as well as mathematical modeling analysis. He defines the overall goal of the research as enhancing the accuracy of risk assessments and improving the effectiveness of remediation strategies for sites contaminated by chlorinated solvents.

#### **G. Arsenic**

SRP has invested in arsenic research for nearly 25 years, funding work in engineering, biomedical science, geology, chemistry, nutrition, and community engagement. The extensive data from these programs could be mined in a coordinated effort to investigate a wide variety of health and exposure topics.

**Columbia University Center Research Center:**

[http://tools.niehs.nih.gov/srp/programs/sbrp\\_Project\\_list.cfm?Project\\_ID=P42ES10349](http://tools.niehs.nih.gov/srp/programs/sbrp_Project_list.cfm?Project_ID=P42ES10349)

**Dartmouth College Superfund Research Center:**

[http://tools.niehs.nih.gov/srp/programs/sbrp\\_Project\\_list.cfm?Project\\_ID=P42ES7373](http://tools.niehs.nih.gov/srp/programs/sbrp_Project_list.cfm?Project_ID=P42ES7373)

**University of Arizona Superfund Research Center:**

[http://tools.niehs.nih.gov/srp/programs/sbrp\\_Project\\_list.cfm?Project\\_ID=P42ES4940](http://tools.niehs.nih.gov/srp/programs/sbrp_Project_list.cfm?Project_ID=P42ES4940)

**University of California-Berkeley:**

[http://tools.niehs.nih.gov/srp/programs/sbrp\\_Project\\_list.cfm?Project\\_ID=P42ES4705](http://tools.niehs.nih.gov/srp/programs/sbrp_Project_list.cfm?Project_ID=P42ES4705)

#### **H. Polychlorinated biphenyls (PCB)**

##### **1. Development of Environmental Sampling Devices**

**Damian Shea, University of North Carolina-Chapel Hill Superfund Research Center**

Dr. Shea is advancing the use of passive sampling devices (PSD) to measure the bioavailable fraction of PCBs and PCB metabolites in water, sediment, and soil. He is conducting laboratory bioavailability experiments with PCB-contaminated soil, sediment and water to advance scientific understanding of the mechanisms controlling PCB bioavailability and perform field verification at NPL sites.

##### **2. Airborne PCBs**

**University of Iowa Superfund Research Center**

Airborne PCBs are the focus of both research and community engagement efforts at UI. Dr. Hornbuckle's project seeks to determine the source and fate of airborne PCB congeners in Chicago air using a novel sampling method. Dr. Thorne's project focuses on PCB exposure of a Chicago cohort and determines emission levels at homes and schools in order to develop exposure profiles. Dr. Robertson's project brings coordination of a multidisciplinary approach to the UI projects that study the source, exposure and toxicity of PCBs in the Chicago area and in the laboratory. Drs. Osterberg and Just lead the Community Outreach Core that seeks to address the community concerns relative to the source, remediation and human impact of PCBs. In addition it seeks to improve scientific literacy of the affected community. The project is exploring various approaches and communication methods and case studies to relate environmental health issues to the community. This project seems to have the essential

components to be a model outreach program for other communities and other chemical exposures.

I. [Analyzing Patterns in Epidemiologic and Toxicologic Data](#)

**Thomas Webster & Ann Aschengrau, Boston University**

The research group is using generalized additive models (GAMs), an extension of logistic regression, and corresponding statistical tests to evaluate whether there is an association between geographic location of residence and disease. These tests are used to determine whether there is some unmeasured environmental exposure putting participants at greater risk. This has interesting possibilities for using computational approaches to discover non-chemical stressors or even background chemicals that are problematic at a site.

J. **Computational Approaches**

[Boston University \(Vajda\)](#) – The researchers have studied a number of specific problems which relate to using genomic (bioinformatic) tools to predict toxicity. This could be useful in deciding which chemicals at a Superfund site might be problematic, and which chemicals should be grouped for the purpose of looking at dose additivity.